

Applicant: Carsten PABST et al.
Docket No. R.306941
Preliminary Amdt.

AMENDMENTS TO THE SPECIFICATION:

Page 1, please add the following new paragraphs before paragraph [0001]:

- [0000.2] CROSS-REFERENCE TO RELATED APPLICATIONS
- [0000.4] This application is a 35 USC 371 application of PCT/DE 2004/002543 filed on November 18, 2004.
- [0000.6] BACKGROUND OF THE INVENTION

Please replace paragraph [0001] with the following amended paragraph:

- [0001] **Prior Art** **Field of the Invention**

Please add the following new paragraph after paragraph [0001]:

- [0001.2] This invention is directed to an improved multipiston pump for use in a vehicle brake system.

Please add the following new paragraph after paragraph [0001.2]:

- [0001.4] Description of the Prior Art

Please replace paragraph [0002] with the following amended paragraph:

- [0002] ~~The invention is based on a multipiston pump as generically defined by the preamble to claim 1.~~ One [[such]] multipiston pump is already known, for instance from US Patent Application No. 64 46 435 B1[.] This multipiston pump which includes a pump drive comprising a rotatably supported shaft and a single cam located on the shaft in a manner fixed against relative rotation. This cam drives an arrangement of a total of six piston pumps, which are arranged radially around the pump drive in the same plane as the pump housing. The pistons of the various piston pumps execute a reciprocating motion and are embodied as stepped pistons, to improve the intake performance. The various piston pumps are

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hydraulically combined into two pump units. Both pump units are in operative communication with one another on the intake side, but serve as pressure generators for two separate brake circuits of a vehicle brake system. The individual piston pumps combined into one pump unit are arranged in a star pattern and have a rotary angle spacing of 120° from each other. Moreover, the first pump unit is phase-offset from the second pump unit by a rotary angle of 30°. Thus none of the piston pumps is in phase opposition to any of the other piston pumps.

Page 3, please replace paragraph [0006] with the following amended paragraph:
[0006] Against this background, the object of the present invention [[was]] **is to propose provide** a multipiston pump which, with unaltered good pulsation performance, can be more easily manufactured and occupies a smaller structural volume. **This object is attained by a multipiston pump having the characteristics of claim 1.**

Please replace paragraph [0007] with the following amended paragraph:
[0007] **Advantages of the Invention**

SUMMARY AND ADVANTAGES OF THE INVENTION

Please replace paragraph [0008] with the following amended paragraph:
[0008] **A subject having the characteristics of claim 1 multipiston pump according to the invention has the advantage over the prior art that the geometric location of the individual piston pumps can be selected essentially independently of their hydraulic function. The connecting conduits of the individual piston pumps can now be located in the region of the pump housing that is defined by the two sectional planes in which the piston pumps are**

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located. This requires fewer diversions and less effort and expense for drilling bores. A hydraulically more direct connection with the various piston pumps is achieved, which is expressed, particularly at low ambient temperatures, in shortened pressure buildup times for the brake system. In the embodiment of the multipiston pump according to the invention, the piston pumps, with optimal hydraulic function (little pulsation on the intake side) can be located more flexibly in terms of geometry, depending on the particular application. For instance, the piston pumps of one pump unit may be placed on a first side of the pump housing, and the piston pumps of the second pump unit may be placed on a diametrically opposite second side of the pump housing, which further shortens the required hydraulic connecting bores of the combined piston pumps of one pump unit. A number of piston pumps acted upon by one cam is also variable. It is furthermore possible to design the cams used as having different eccentricities, and to assign special conditions to them within the brake system. Finally, the components of the two brake circuits can be spatially well separated from one another and as a result can be dimensioned and protected more specifically in terms of their endurance strength.

Page 4, please delete paragraph [0010].

Please replace paragraph [0011] with the following amended paragraph:

[0011] Drawing **BRIEF DESCRIPTION OF THE DRAWINGS**

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Please replace paragraph [0012] with the following amended paragraph:

[0012] One exemplary embodiment of the invention is shown in the drawing and described in further detail in the ensuing description described more fully herein below, in conjunction with the drawings, in which:

Please delete paragraph [0013].

Please replace paragraph [0014] with the following amended paragraph:

[0014] Fig. 1[[],] is a perspective view of a pumping housing, embodied according to the invention, of a multipiston pump;

Page 5, please replace paragraph [0015] with the following amended paragraph:

[0015] Fig. 2[[],] is schematically simplified, side view of a pump drive, embodied according to the invention, of [[this]] the multipiston pump in a side view of Fig. 1;

Please replace paragraph [0016] with the following amended paragraph:

[0016] Fig. 3[[],] is a perspective view of the pump drive viewed from the front; and

Please replace paragraph [0017] with the following amended paragraph:

[0017] Fig. 4[[],] [[in]] is a partly schematic view[[],] of the geometric arrangement, hydraulic interconnection, and construction of the individual piston pumps of the multipiston pump inside the pump housing.

Please replace paragraph [0018] with the following amended paragraph:

[0018] Description of the Exemplary Embodiment

DESCRIPTION OF THE PREFERRED EMBODIMENT

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Page 12, please replace paragraph [0032] with the following amended paragraph:

[0032] In the case of a second pump unit 30b, a first low-pressure connecting conduit 33a begins at the end face of the upper right-angled step, in terms of Fig. 1, on the front side 16 of the pump housing 10, extends vertically in the longitudinal direction of the pump housing 10, and ends in the receptacle 28f, located diagonally in the pump housing 10, for the first piston pump of this second pump unit 30b. A second low-pressure connecting conduit 33b begins on the left-hand outside, in terms of Fig. 1, of the pump housing 10, extends transversely to the first low-pressure connecting conduit 33a, penetrates it, and ends in the receptacle 28d, discharging toward the upper step of the front side 16, for a second piston pump of the second pump unit 30b. Both low-pressure connecting conduits 33a, 33b are widened in diameter on the outsides of the pump housing 10 and are closed off in pressure-fluid-tight fashion from the environment in this region. A third low-pressure connecting conduit 33c begins on a bottom face of the blind-borelike valve receiving chamber 34i on the back side 14 of the pump housing 10, extends perpendicular to the sectional planes E1 and E2 through the pump housing 10 in the direction of the front side 16,[[l]] penetrates the first low-pressure connecting conduit 33a, and discharges directly into the receptacle 28c for the third piston pump of this pump unit 30b.

Page 15, please replace paragraph [0039] with the following amended paragraph:

[0039] A master cylinder, which is known per se in terms of its construction, has two separate brake circuits (Fig. 4, positions I, II), so that for each brake circuit I, II there is its own connection 42a, 42b on the pump housing 10. Beginning at each of these master

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cylinder connections 42a, 42b, a vertical conduit 44a, b leads indirectly to built-in chambers 46a, b, embodied on the lower face end of the pump housing 10, for low-pressure reservoirs. Along their ways through the pump housing 10, the conduits 44a, b penetrate the valve receiving chambers 34i and 34k of the high-pressure switching valves. Blind-borelike conduits 44c and 44d, which begin at the left and right ~~outsides~~ outside surfaces, respectively, of the pump housing 10 and are oriented vertically to the conduits 44a, b, respectively, establish a pressure fluid communication between the valve receiving chambers 34l and 34m and these vertically extending conduits 44a and 44b. These conduits 44c, d are likewise closed off from the environment. They extend, together with the conduits 44a and 44b, in a further common sectional plane of the pump housing 10. This sectional plane is not shown in the drawing in Fig. 1, because it is located outside the region of the pump housing 10 that is defined by the two sectional planes E1 and E2 and that is definitive for the invention. This last sectional plane is offset still farther toward the back side 14 of the pump housing 10, relative to the sectional plane E2.

Page 18, please replace paragraph [0046] with the following amended paragraph:

[0046] When the service brake 58 is functional, the furnishing of the brake pressure is done not by the muscular force of the driver but rather by external force, in the form of an electrically driven multipiston pump 66. As already noted in conjunction with Fig. 1, the multipiston pump 66 has a total of six piston pumps 76a-f. Their pistons 78a-f are embodied as stepped pistons. Stepped pistons, as their name indicates, are stepped a single time in their outer diameter. Thus a stepped piston, in its associated cylinder, defines two pressure

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chambers 80a, b that are separated from one another. These pressure chambers 80a, b change their volume in phase opposition to one another. In other words, the volume of one pressure chamber 80a increases while the volume of the other pressure chamber 80b associated with it is decreasing. The two pressure chambers 80a, b have volumes of different sizes and communicate with one another via an interposed check valve 82. As soon as a pressure buildup takes place in the larger-volume pressure chamber 80a, this check valve 82 ~~blocks~~ closes. Stepped piston pumps of this kind are known per se, and there is accordingly no need to describe their function in detail below. Stepped piston pumps are distinguished by having substantially improved pulsation behavior on the intake side than conventional piston pumps that have non-stepped pistons.

Page 22, please add the following new paragraph after paragraph [0049]:

[0050] The foregoing relates to a preferred exemplary embodiment of the invention, it being understood that other variants and embodiments thereof are possible within the spirit and scope of the invention, the latter being defined by the appended claims.